Journal Homepage: - www.journalijar.com
INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)
Article DOI: 10.21474/IJAR01/2760
DOI URL: http://dx.doi.org/10.21474/IJAR01/2760
ISSN NO. 2320-5407

RESEARCH ARTICLE

EVALUATION OF BITE FORCE AMONG DIFFERENT AGE GROUPS IN VISAKHAPATNAM DISTRICT.

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Manuscript Info

Manuscript History

Received: 15 November 2016
Final Accepted: 17 December 2016
Published: January 2017

Key words:-
Maximum voluntary bite force, masticatory mechanism, jaw muscles.

Abstract

Bite force is an important aspect of masticatory system. Bite force assesses masticatory muscle function under clinical and experimental conditions. Measurement of maximum voluntary bite force (MVBF) in 100 individuals including males and females has been used for understanding masticatory mechanism, to evaluate the physiological characteristics of jaw muscles and study the effect of different physiological and morphological factors. The subject related factors includes- age, gender, periodontal support, height, weight, craniofacial morphology, malocclusion, temporomandibular disorder (TMD) pain. Therefore, bite force is used as a variable for evaluating masticatory function.

Introduction:-

Face, being the most admired point in the human body and Mandible, despite being the largest and strongest facial bone, the muscular attachments and their influence and presence of developing or developed dentition play an important role in producing the inherent weakness.

Bite force is the force applied in dental occlusion, which is the important aspect of masticatory muscular system. It is used to understand the underlying masticatory mechanism, to study the effect of different physiological and morphological factors such as age, gender, periodontal support of the teeth, height and body weight, craniofacial morphology, presence of malocclusion, temporomandibular disorder (TMD) pain and also to evaluate the physiological characteristics of jaw muscles. Other variables reportedly affecting the bite force are the type of recording devices, technique employed to measure the bite force, position of sensor in the oral cavity, patient position, unilateral or bilateral measurements and magnitude of mouth opening during measurements[1].

Masseter, the anti-gravity muscle, has a special consideration among all the masticatory muscles such as masseter, temporalis, medial pterygoid and lateral pterygoid in the quantitative assessment of the strength of the muscles. The relationship of maximum voluntary bite force and masticatory system is well documented in literature to indicate the health of stomatognathic system[2]. The main aim of this study was to evaluate the Maximum voluntary bite force among different age groups in both males and females in Visakhapatnam District.

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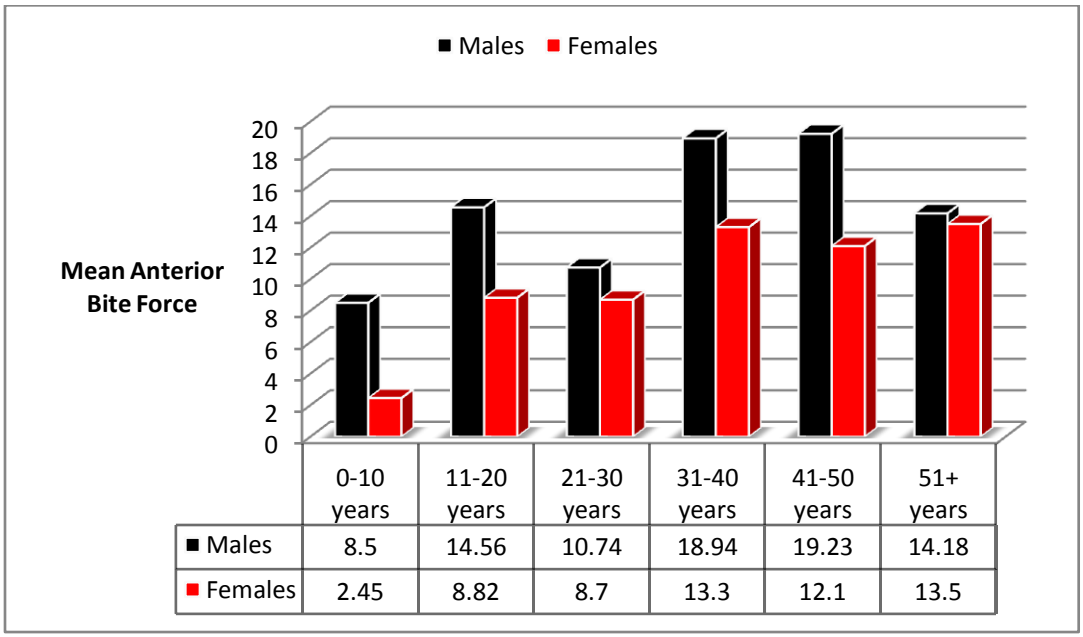
Materials and methods:-

This study was conducted in 100 healthy individuals (51 males and 49 females) of Visakhapatnam District. The individuals were randomly selected for the study after the Ethical Committee approval. The total numbers of individuals are broadly categorized under six age groups i.e. 0-10, 11-20, 21-30, 31-40, 41-50, 51+ groups. Individuals with any kind of syndromes, degenerative diseases, mental deficiencies, malformation, changes of the temporomandibular articulation, open-bite and cross-bite, crowns and restorations, myofunctional changes of masticatory muscles and dental implants have been excluded from the present study.

The procedure involves a bite force meter which has a biting sensor. The individual is informed about the experimental procedure and the subject was seated comfortably in a chair in an upright position. A polythene sheet or a plastic wrapper was used to cover the biting sensor. The operator holds the holding instrument and it is used to load the bite force on the bite force sensor. It is placed on the incisal edge of the anterior teeth for measuring anterior bite force (ABF) and then placed on the occlusal surface of the first molar on the right side for measuring the right posterior bite force (RBF) and then placed on the occlusal surface of the first molar on the left side for measuring the left posterior bite force (LBF). The subjects were asked to bite hard on the sensor and the maximum bite force reading on the charge meter display was recorded. Three such readings were taken, alternated on each side, with an interval of 1 minute to avoid muscular fatigue. To reduce the error and bias in the study, a single operator has recorded the bite force in all the subjects. The highest among all these three consecutive records on either side was taken as the Maximum Voluntary Bite Force of that side. The mounting was repeated for each healthy subject on the anterior and bilateral posterior sides. The bite force transducers were disinfected before the experiments by immersing them in a disinfectant solution. The transducer was calibrated on each day of experimentation.

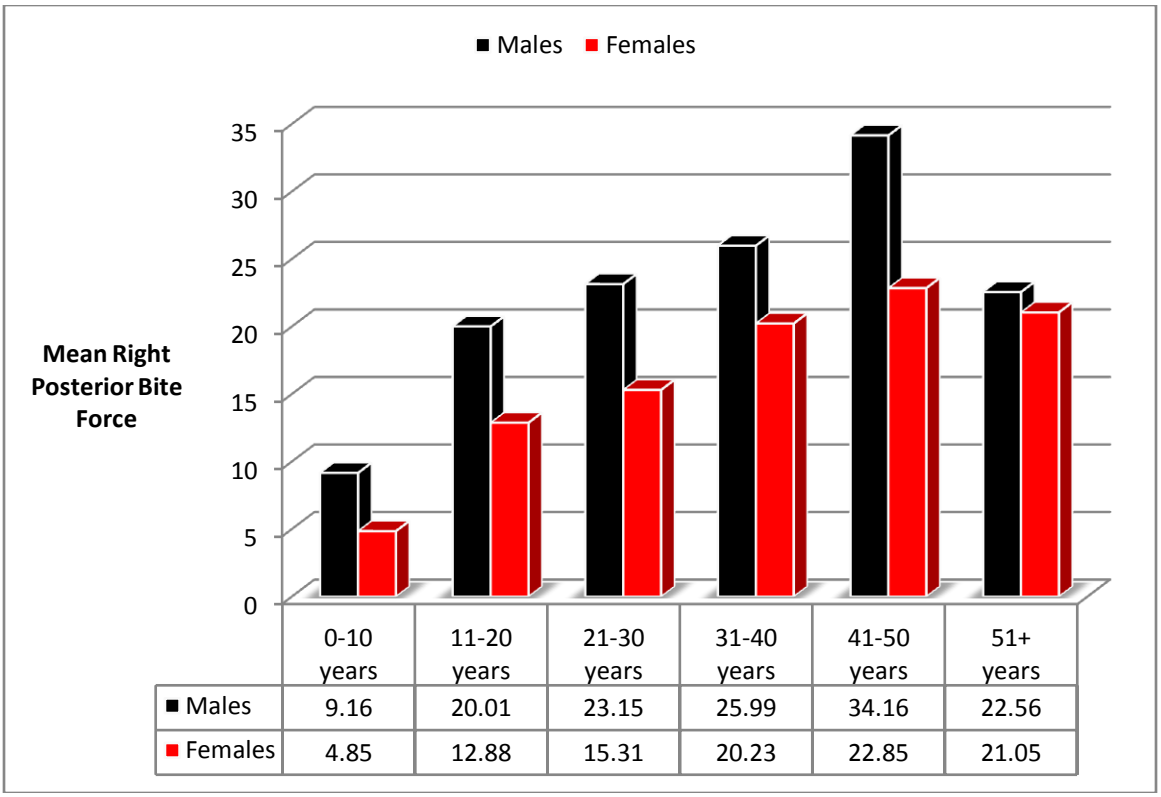
Results:-

The statistical analysis was done by Mann Whitney Test to find of the statistical difference of bite force between males and females in different age groups. In both anterior and posterior region, the highest mean bite force is recorded in males in the age group of 41-50years (Fig 1, 2, 3). In the anterior and posterior region, the lowest mean bite force is recorded in females in the age group 0-10 (Fig 1, 2, 3). The mean bite force has increased as the age increases in the anterior and posterior region till the age group of 41-50 years. In the age group with above 51 years of age, there is a decrease in the mean bite force of all the males and females in both anterior and posterior region.



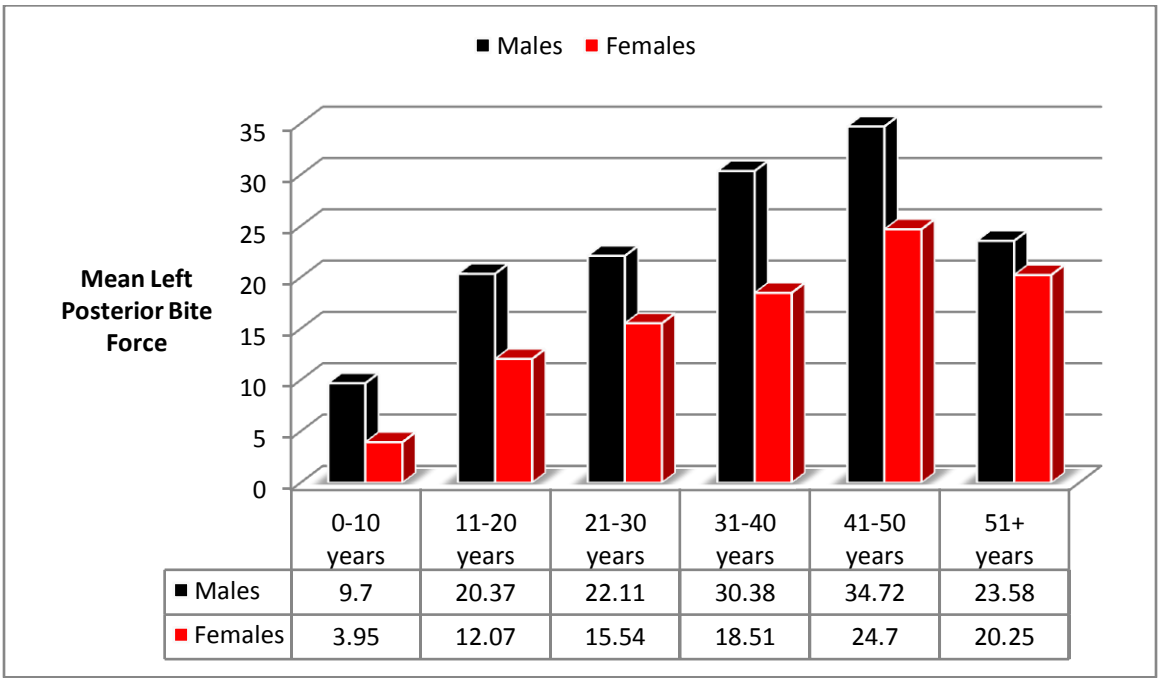
	0-10 years	11-20 years	21-30 years	31-40 years	41-50 years	51+ years
Males	8.5	14.56	10.74	18.94	19.23	14.18
Females	2.45	8.82	8.7	13.3	12.1	13.5

Fig 1. Mean of Anterior Bite Force



	0-10 years	11-20 years	21-30 years	31-40 years	41-50 years	51+ years
Males	9.16	20.01	23.15	25.99	34.16	22.56
Females	4.85	12.88	15.31	20.23	22.85	21.05

Fig 2. Mean of Right Posterior Bite Force



	0-10 years	11-20 years	21-30 years	31-40 years	41-50 years	51+ years
Males	9.7	20.37	22.11	30.38	34.72	23.58
Females	3.95	12.07	15.54	18.51	24.7	20.25

Fig 3.Mean of Left Posterior Bite Force

Discussion:-

Bite force is an important element of masticatory system. Masticatory performance is a cumulative contribution of various factors like bite force, severity of malocclusion, occlusal contact area, body loss of teeth, restorations, facial forms and other motor activities. Bite force has also shown to be affected by a number of variables such as

craniofacial morphology, age, gender, periodontal support of the teeth, height and body weight, temporomandibular disorders pain, and dental status and also other variables include the type of recording devices, technique employed to measure the bite force, position of the sensor in the oral cavity, patient position, unilateral or bilateral measurements and magnitude of mouth opening during measurements.

According to Suzana Varga et al[3], bite force measurements were undertaken using a portable occlusal force gauge on both the left and the right sides of the jaw in the first molar region during maximal clenching. Two independent samples t-tests and multiple regressions were used for statistical analysis. MVBFs were age and gender related. Males showed a significant increase in bite force between 15 and 18 years of age, but gender differences were significant only in the 18-year-olds. In subjects with a neutral occlusion, MVBF could best be predicted using multiple regressions from age and gender. Morphological occlusion, jaw function, and BMI explained the remaining variance.

According to Virgilio F. Ferrario et al[4] conducted a study to assess the repeatability of maximal bite force estimates as obtained by sub-maximal electromyographic-force relationships performed simultaneously and symmetrically in both sides of the mouth. The protocol could be used in a clinical context to obtain indicative values for the occlusal loads to be resisted by the prosthetic reconstructions. Ten young healthy subjects performed; (1) a maximum voluntary clench (MVC) directly on their occlusal surfaces; (2) four simultaneous recording of sub-maximal bite forces on two transducers positioned on the left and right first mandibular molars) and surface EMG potentials of the masseter and temporalis anterior muscles. The actual force peak value was recorded. For each subject, a linear regression was run between the simultaneous bite force and EMG sub-maximal values recorded in the four tests. Using the EMG potentials obtained during the MVC tests, the best fitting line was used to estimate a maximum bite force. Two independent recordings were made by each subject (2 week interval) and analyzed by correlation analysis, paired Student's t-test, and Dahlberg statistic. Significant linear relationships were found between bite force and EMG potentials. The two series of indirect estimates of maximal bite force were correlated; without systematic differences. Simultaneously recorded sub-maximal bite forces and surface EMG potentials of mandibular elevator muscles had a linear relationship. The estimates of maximum bite force were repeatable on a short-term basis. The method limited the disadvantages of bite force recordings, and it could be used to obtain indicative values for the occlusal loads to be resisted by the prosthetic reconstructions.

According to Kazunori Ikebe et al[5]**,** investigated the effect of ageing, occlusal support and TMJ condition and general health status on bite force in older adults. The study sample consisted of 850 independently-living people over the age of 60 years. Bilateral maximal bite force in the intercuspal position was measured with pressure sensitive sheets. TMJ noise by palpation and limitation of mouth opening (less than 40 mm) were assessed. Subjects were grouped into three categories by occlusal support according to the Eichner Index. A multiple logistic regression analysis showed that whether participants had low bite force or not was significantly associated with gender, age, self-rated general health and occlusal support, but not TMJ noise or mouth opening limitation. Overall bite force showed a statistically significant but weak negative Spearman's correlation with age. However, there was no significant correlation between age and bite force in the Eichner C group for males or in any of the Eichner classification for females. Decline of occlusal support and general health might translate into reduction of bite force with ageing in older adults. Since tooth loss is not physiological ageing but pathological ageing, it cannot be shown that reduction of bite force is a natural effect of ageing.

According to C. M. Serra & A. E. Manns et al[6]**,** bite force has been measured by different methods and over a wide variety of designs. In several instruments, the fact that bite surface has been manufactured with stiff materials might interfere in obtaining reliable data, by a more prompt activation of inhibitory reflex mechanisms. The purpose of this study was to compare the maximum voluntary bite force measured by a digital occlusal force gauge (GM10 Nagano Keiki, Japan) between different opponent teeth, employing semi-hard or soft bite surfaces. A sample of 34 young adults with complete natural dentition was studied. The original semi-hard bite surface was exchanged by a soft one, made of leather and rubber. Maximum voluntary bite force recordings were made for each tooth group and for both bite surfaces. Statistical analyses (Student's t-test) revealed significant differences, with higher scores while using the soft surface across sexes and tooth groups. Differential activation of periodontal mechanoreceptors of a specific tooth group is mainly conditioned by the hardness of the bite surface; a soft surface induces greater activation of elevator musculature, while a hard one induces inhibition more promptly. Thus, soft bite surfaces are recommended for higher reliability in maximum voluntary bite force recordings.

Therefore, bite force is an important aspect of human masticatory system. Assessing the bite force provides the assessment of masticatory muscle function under clinical and experimental conditions. Maximum Voluntary Bite Force (MVBF) is an indicator of the functional condition of the masticatory system, resulting from the combined action of the jaw closing muscles and is modified by jaw biomechanics and reflexes. All the skeletal, muscular, and nervous systems will have an effect on bite force, and the condition of these systems will influence the biting ability of an individual.

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